Cotton Plants: A Preliminary GOSSYM Model

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ABSTRACT

Cotton plant growth data developed from 1973 to 1976 are presented with the available bioclimatic, soil, and agronomic data for Deltapine 16 and Stoneville 213 varieties. The data are intended for use in validating cotton plant simulations for the Southwestern United States. Validation of the cotton plant simulation model, GOSSYM, for Arizona conditions required adjustment of the Mississippi model form to compensate for increased water stress. Plant height and numbers of main stem nodes, fruiting sites, squares, and bolls were predicted correctly by the simulation after these adjustments.

The preliminary attempt at validation suggests additional research on moisture stress in cotton plants will be necessary to generalize GOSSYM. Fruit retention data indicate that 90 percent of the 1974 crop at Marana, Ariz., was comprised of fruit from forms produced in July.

KEYWORDS: Cotton, cotton growth, cotton simulation model, GOSSYM, cotton leaf surface.

SUMMARY

Preliminary attempts to validate the cotton plant growth model GOSSYM for Arizona conditions required adjustment of water stress factors used in the original Mississippi model. When the water stress was increased, the model correctly predicted the plant height and numbers of main stem nodes, fruiting sites, squares, and bolls of Arizona cotton. Additional research on the effects of moisture stress on a cotton plant was suggested by the attempted validation method. Fruit retention studies indicated that the major portion of final crops in Arizona was comprised of fruit from forms produced in July.

CONTENTS

COTTON PLANTS: A PRELIMINARY GOSSYM MODEL

By R. E. Fye, V. R. Reddy, and D. N. Baker[1]

INTRODUCTION

Four major models have been developed for the cotton plants. Stapleton et al. (*7*)[2] provided the first model that simulated Arizona cotton and a sound basis for future simulations. McKinion et al. (*6*) later developed SIMCOT II for Mississippi cotton. This was consolidated with an array of additional ancillary models to form GOSSYM (*1*). Gutierrez et al. (*5*) developed models for Acala cottons in California with slightly different approaches.

To bring such models into a form that will accurately describe cotton plant response under varying environmental conditions, it is essential to attempt validations with field data. The attempted validations will indicate the usefulness of current versions of a model, and any necessary changes in the model will usually indicate fruitful areas of research that will improve generalization of the model and elucidate plant physiological functions. The following study was conducted to provide data for validation attempts with GOSSYM (*1*) for the Southwest and to provide a starting point for interfacing cotton insect populations with cotton plants utilizing insect developmental data (*3*) based on cotton plant temperatures (*2*).

METHODS AND MATERIALS

Plant Selection

In 1973 and 1974, the heights of 100 plants were measured. The measurements were from the cotyledon node to the base of the terminal bud. The mean height was then determined in the field, and plants within 1 cm of the mean height were selected for analysis. Twenty-five plants were collected in 1973 and 30 plants in 1974. In 1976, 30 plants were randomly selected without regard to height.

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[2] Italic numbers in parentheses refer to Literature Cited, p. 6.

Analysis

The cut plants were transported to the laboratory and refrigerated until the detailed analysis could be made. In 1973 and 1974, the plants were mapped and measured. In the mapping process, the plants were dissected into their respective components, and the material was placed in the oven for drying. When the material had reached a constant weight, the dry weights were determined.

In 1976, the analysis consisted of a count of the fruiting nodes with the numbers and sizes of the squares and bolls determined. In addition, the leaf area was measured with a standard leaf area meter.

Bioclimatic Factors

Solar radiation was measured with a standard weekly recording pyroheliometer. For analyses, the charts were read at 1-hour intervals and the mean radiant flux density for each hour was determined and utilized in the summations of the total radiation.

In all years, the temperature and relative humidity were recorded with a hygrothermograph placed in a standard weather instrument shelter.

Rainfall was recorded with a standard recording rain gage. The evaporative rate was recorded with a recording evaporimeter placed in a standard weather instrument shelter. These readings may be low as compared with those from a standard evaporation pan.

Agronomic Factors

The agronomic data were derived from field notes and from the records of the growers. The plant density was determined by counting the numbers of plants on 1 m of row in 100 locations in the commercial fields. In 1976, adjacent sections of the field were thinned to the desired densities with the higher plant density representative of the stand in the test field.

Soils

The general soil descriptions are paraphrased from the USDA Soil Conservation Service descriptions. The hydraulic conductivity of the soil at the Marana farm may be found in Stockton and Warrick (*8*). In 1976, tensiometers were installed in the two plant densities and read about three times weekly.

Plant Emergence

In 1976, plant emergence was studied by delineating the areas planted daily by the grower. From the time of planting until the plants initiated the third

true leaf, the plots were inspected daily and the state of growth was recorded. The bioclimatic records were taken in the manner described above.

Fruit Retention

In 1974, the fruit on five plants in each of nine rows were tagged at several intervals through the growing season. On each successive date of tagging, the five plants immediately adjacent to those tagged the previous date were tagged. The tags were coded to indicate if a square, bloom, or boll had been tagged, and the tags were placed so that they remained on the plant if the fruit abscised. Between the 10th and 12th of September, the fate of the tagged fruit was determined, and the subsequent boll set was established. Thus, the fruit retention at several intervals through the summer was determined. The test was conducted at Marana, Ariz., at the University of Arizona Agricultural Research Station.

Model Validation and Conclusions

We have previously reported the preliminary validation of GOSSYM with our 1976 data from Arizona (4) (tables 1 to 6 and Appendix B.)[3] To determine if the prior changes provided a general form of GOSSYM that would apply to Arizona conditions, we tested the revised form with the 1973 data (tables 1, 3, and 4). The following additional changes[4] were made to simulate the 1973 plants:

The DUMY variables used in calculating boll growth are calculated as a function of water stress, length of day and night, and temperatures during the day and night.

```
DUMY01=(0.0160791*TDAY-0.2120865)*DAYTYM*WSTRSD

DUMY02=(0.03125*TDAY-0.0508125)*DAYTYM*WSTRSD

DUMY03=(2.73285-0.082857*TDAY)*DAYTYM*WSTRSD

DUMY09=(0.0160791*TNYT-0.2120865)*NYTTYM*WSTRSN

DUMY07=(0.03125*TNYT-0.0508125)*NYTTYM*WSTRSN

DUMY08=(2.73285-0.082857T*NYT)*NYTTYM*WSTRSN
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For simulating the boll growth under the dry conditions of 1973, we increased the effect of water stress by squaring the WSTRSD and WSTRSN terms on DUMY variables.

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[3]Tables appear in Appendix A, and agronomic data appear in Appendix B.
[4]A dictionary of FORTRAN terms appears in Appendix C.

DUMY01=(0.0160791*TDAY-0.2120865)*DAYTYM*WSTRSD*WSTRSD

DUMY02=(0.03125*TDAY-0.0508125)*DAYTYM*WSTRSD*WSTRSD

DUMY03=(2.73285-0.082857*TDAY)*DAYTYM*WSTRSD*WSTRSD

DUMY09=(0.0160791*TNYT-0.2120865)*NYTTYM*WSTRSN*WSTRSN

DUMY07=(0.03125*TNYT-0.0508125)*NYTTYM*WSTRSN*WSTRSN

DUMY08=(2.73285-0.082857*TNYT)*NYTTYM*WSTRSN*WSTRSN

The following parameters were changed while executing the program:

XTR_4	CZN	CSQ	CBL	CPF
2.20	2.10	1.35	0.05	0.93

These parameters were changed to:

XTR_4	CZN	CSQ	CBL	CPF
2.10	1.60	0.88	0.01	0.86

The above parameters are used in the following equations:

(1) XTR_4

if(FRATIO.LT..20)FLOSS=XTR4-3.60717*FSTRES+1.6047*.FSTRES**2.

By decreasing XTR_4 parameter from 2.20 to 2.10, we decreased the square loss in response to metabolic stress (FSTRES).

(2) CSQ:

if(FRATIO..20)FLOSS=CSQ-3.60717*FSTRES+1.6047*.FSTRES**2.

By decreasing the parameter for CSQ, we decreased the loss of bolls in response to metabolic stress (FSTRES).

(3) CZN and CPF:

DZ=CZN-.34*AGE(1,L,1)

if(FCODE(1,3,1).NE.0)DZ=(6.17623F-1.130496*AGETOP+.0547083*AGETOP*AGETOP)*CPF.

By decreasing the parameters for CZN and CPF, we decreased the rate of growth in plant height.

(4) CBL:

AGENOD=AGE(K,L,M)-SCDLAY(K,L,M)*CBL.

Here, CBL adjusts physiological delays by adjusting the time at which squares become bolls.

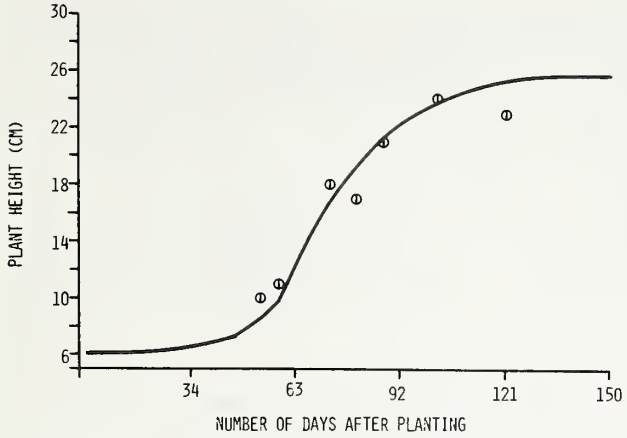

Figure 1.--Simulation of cotton plant height by modified GOSSYM, Robles Junction, Ariz., 1973.

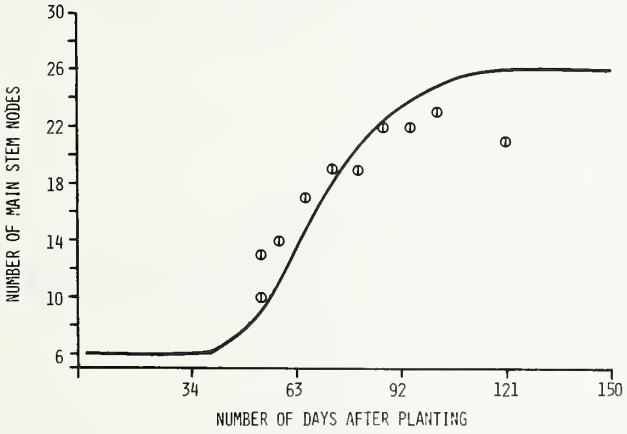

Figure 2.--Simulation of number of main stem nodes by modified GOSSYM, Robles Junction, Ariz., 1973.

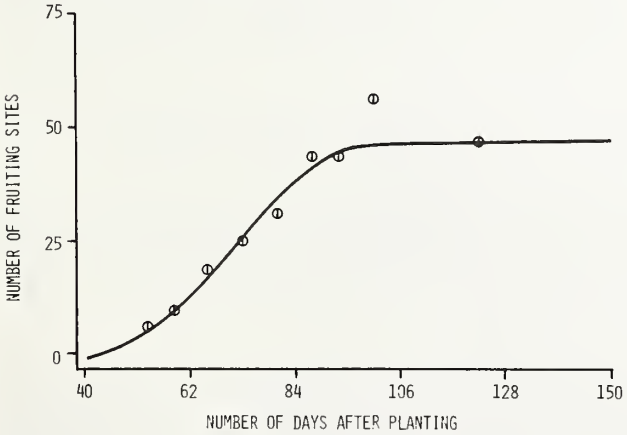

Figure 3.--Number of fruiting sites by modified GOSSYM, Robles Junction, Ariz., 1973.

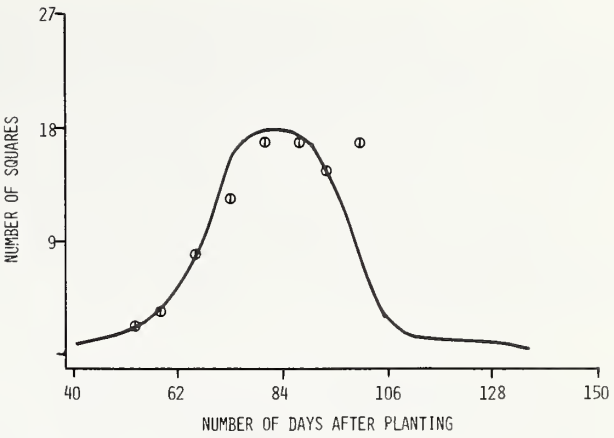

Figure 4.--Number of squares by modified GOSSYM, Robles Junction, Ariz., 1973.

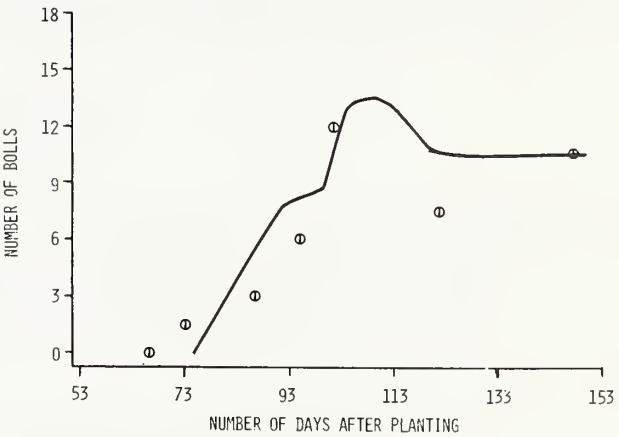

Figure 5.--Number of bolls by modified GOSSYM, Robles Junction, Ariz., 1973.

With these additional changes to the revised form of GOSSYM (*1*), the model properly simulates the 1973 plant heights (fig. 1), main stem node numbers (fig. 2), fruiting sites (fig. 3), square production (fig. 4), and boll production (fig. 5). The estimated yield was 2.3 bales-per-acre, slightly above the more than 2.0 bales-per-acre average for the entire ranch.

Again, the changes necessary were associated with moisture stress, indicating that the disparity between the Mississippi and Arizona growing conditions are not fully resolved by the model. The changes necessary suggest areas of research that will be essential to place GOSSYM in an effective generalized form.

The preliminary fruit retention data (table 7) show that about 90 percent of the final fruit set is comprised of fruit from forms produced during July. Thus, the economic vulnerability to insect attack on squares is highest in July and on bolls in August and later. Insects such as lygus bugs and bollworms would most effectively reduce the crop in July, and the impact of boll feeding bollworms and pink bollworms would be greatest in August. Field monitoring of populations of these insects indicates this is generally true. The data provide the basis for developing field experimental designs necessary to fully evaluate the impact of these insects on southwestern cotton.

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APPENDIX A.--BIOCLIMATIC AND GROWTH DATA

Table 1.--*Climatic data in the format of GOSSYM with modifications*

Parameters[1]						
Robles Junction, Ariz., 1973						
A	B	C	D	E	F	G
0	69	50	0	0.000.00		108
0	71	46	0	0.000.00		109
0	60	46	0	0.100.00		110
0	71	41	0	0.000.00		111
0	82	39	0	0.000.00		112
0	80	44	0	0.000.00		113
0	80	44	0	0.000.00		114
0	86	48	0	0.000.00		115
0	89	50	0	0.000.00		116
0	95	46	0	0.000.00		117
0	86	53	0	0.000.00		118
0	73	59	0	0.000.00		119
0	68	48	0	0.000.00		120
0	73	41	0	0.050.00		121
0	84	39	0	0.000.00		122
0	89	46	0	0.000.00		123
0	82	50	0	0.000.00		124
0	75	51	0	0.050.00		125
0	75	41	0	0.000.00		126
0	84	44	0	0.000.00		127
0	89	48	0	0.000.00		128
0	93	50	0	0.000.00		129
0	98	53	0	0.000.00		130
0	96	55	0	0.000.00		131
0	95	51	0	0.000.00		132
0	95	53	0	0.000.00		133
0	93	50	0	0.000.00		134
0	89	50	0	0.000.00		135
0	89	51	0	0.000.00		136
0	95	57	0	0.000.00		137
0	98	57	0	0.000.00		138
0	98	55	0	0.000.00		139
0	93	60	0	0.000.00		140
0	91	57	0	0.000.00		141
0	91	55	0	0.000.00		142
0	93	55	0	0.000.00		143
0	93	51	0	0.000.00		144
0	91	60	0	0.000.00		145
0	91	64	0	0.000.00		146
0	93	59	0	0.000.00		147

Robles Junction, Ariz., 1974						
A	B	C	D	E	F	G
478	77	41	0	0.000.00		91
448	73	50	0	0.000.00		92
520	69	39	0	0.000.00		93
562	69	32	0	0.000.00		94
542	87	33	0	0.000.00		95
545	84	44	0	0.000.00		96
534	82	42	0	0.000.00		97
501	91	41	0	0.000.00		98
413	80	50	0	0.000.00		99
491	62	41	0	0.000.00		100
481	69	39	0	0.000.00		101
509	77	42	0	0.000.00		102
532	77	39	0	0.000.00		103
515	80	37	0	0.000.00		104
530	84	37	0	0.000.00		105
478	86	42	0	0.000.00		106
531	87	42	0	0.000.00		107
487	80	48	0	0.000.00		108
560	75	51	0	0.000.49		109
578	77	39	0	0.000.33		110
553	77	41	0	0.000.19		111
531	89	42	0	0.000.24		112
300	86	50	0	0.000.20		113
322	87	51	0	0.000.46		114
161	82	57	0	0.000.29		115
526	84	46	0	0.000.18		116
487	84	44	0	0.000.42		117
554	82	46	0	0.000.30		118
568	84	46	0	0.000.22		119
438	84	44	0	0.000.10		120
541	87	48	0	0.000.30		121
397	87	44	0	0.000.32		122
526	84	46	0	0.000.39		123
560	84	50	0	0.000.55		124
563	82	46	0	0.000.36		125
533	86	46	0	0.000.35		126
557	62	50	0	0.000.18		127
559	86	57	0	0.000.22		128
524	53	53	0	0.000.27		129
520	82	59	0	0.000.40		130

Table 1.--*Climatic data in the format of GOSSYM with modifications*--Continued

Parameters[1]

Robles Junction, Ariz., 1973							Robles Junction, Ariz., 1974						
A	B	C	D	E	F	G	A	B	C	D	E	F	G
0	98	53	0	0.000.00		148	554	93	50	0	0.000.28		131
0102		59	0	0.000.00		149	539	84	55	0	0.000.29		132
0	98	60	0	0.000.00		150	514	87	64	0	0.000.73		133
0	93	68	0	0.000.00		151	584	89	46	0	0.000.38		134
0	87	59	0	0.000.00		152	583	89	51	0	0.000.51		135
0	87	57	0	0.000.00		153	525	89	59	0	0.000.51		136
0	93	55	0	0.000.00		154	436	84	57	0	0.000.62		137
0	96	51	0	0.000.00		155	509	87	44	0	0.000.51		138
0100		57	0	0.000.00		156	595	69	48	0	0.000.49		139
0105		60	0	0.000.00		157	587	75	42	0	0.000.38		140
0105		64	0	0.000.00		158	595	86	37	0	0.000.35		141
0107		64	0	0.000.00		159	485	93	51	0	0.000.39		142
0105		69	0	0.000.00		160	484	95	55	0	0.000.30		143
0104		75	0	0.000.00		161	567	91	48	0	0.000.44		144
0100		75	0	0.000.00		162	559	96	51	0	0.000.25		145
0	78	62	0	0.250.00		163	563104		59	0	0.000.26		146
0	77	59	0	0.000.00		164	556102		59	0	0.000.44		147
0	89	55	0	0.000.00		165	538	95	69	0	0.000.52		148
0	91	59	0	0.000.00		166	567	95	59	0	0.000.61		149
0	95	50	0	0.000.00		167	496	89	50	0	0.000.62		150
0	98	57	0	0.000.00		168	610	87	51	0	0.000.36		151
0	98	59	0	0.000.00		169	608	93	50	0	0.000.48		152
0	96	59	0	0.000.00		170	587	95	53	0	0.000.31		153
601105		50	0	0.000.49		171	614	95	53	0	0.000.49		154
593	98	66	0	0.000.56		172	601	95	53	0	0.000.36		155
629	98	64	0	0.000.69		173	569	95	50	0	0.000.34		156
623100		64	0	0.000.65		174	551	95	50	0	0.000.54		157
556104		59	0	0.000.62		175	521	91	68	0	0.000.64		158
594105		71	0	0.000.47		176	589	89	60	0	0.000.92		159
535105		75	0	0.000.64		177	583	96	55	0	0.000.28		160
559109		68	0	0.000.58		178	582104		53	0	0.000.31		161
553109		73	0	0.000.68		179	588102		57	0	0.000.36		162
561107		77	0	0.000.76		180	600104		59	0	0.000.46		163
461104		77	0	0.000.53		181	542104		64	0	0.000.58		164
446104		68	0	0.000.44		182	565104		66	0	0.000.94		165
554109		75	0	0.000.50		183	508104		64	0	0.000.81		166
508107		75	0	0.100.82		184	539105		60	0	0.000.70		167
554107		77	0	0.000.44		185	504105		62	0	0.000.70		168
547107		71	0	0.450.58		186	504105		60	0	0.000.70		169
528100		73	0	0.000.59		187	490104		66	0	0.000.70		170
514102		73	0	0.000.50		188	482104		60	0	0.000.58		171
386104		71	0	0.000.34		189	554105		62	0	0.000.77		172
545105		69	0	0.000.32		190	565105		62	0	0.000.59		173

Table 1.--*Climatic data in the format of GOSSYM with modifications*--Continued

Parameters[1]

Robles Junction, Ariz., 1973							Robles Junction, Ariz., 1974						
A	B	C	D	E	F	G	A	B	C	D	E	F	G
508104	77	0	0.000	.56	191		499109	69	0	0.000	.84	174	
358	98	71	0	0.500	.50	192	508104	75	0	0.250	.54	175	
406	95	69	0	0.000	.28	193	431102	69	0	0.000	.73	176	
377	93	69	0	0.650	.19	194	488104	71	0	0.000	.62	177	
306	89	68	0	0.250	.18	195	510105	73	0	0.000	.74	178	
310	89	68	0	0.250	.17	196	520107	78	0	0.000	.81	179	
310	89	66	0	0.000	.16	197	526104	78	0	0.000	.88	180	
331	91	64	0	0.000	.24	198	535102	77	0	0.000	.71	181	
467	95	66	0	0.000	.22	199	430100	77	0	0.000	.66	182	
542100	68	0	0.000	.34	200		478	96	73	0	0.000	.39	183
587102	66	0	0.000	.48	201		501	96	71	0	0.000	.70	184
611100	66	0	0.000	.58	202		479100	62	0	0.000	.40	185	
634100	60	0	0.000	.80	203		484100	71	0	0.000	.46	186	
613102	62	0	0.000	.49	204		391	93	68	0	0.000	.59	187
503104	64	0	0.000	.68	205		265	82	66	0	0.600	.35	188
557104	64	0	0.000	.46	206		492	91	66	0	0.000	.18	189
490102	69	0	0.650	.50	207		543	93	62	0	0.000	.43	190
349	93	71	0	0.000	.36	208	542	95	57	0	0.000	.52	191
452	93	69	0	0.000	.28	209	562	96	59	0	0.000	.51	192
370	89	69	0	0.050	.34	210	429	95	69	0	0.000	.48	193
480	93	68	0	0.000	.33	211	395	95	69	0	0.000	.42	194
521	98	69	0	0.000	.38	212	439	89	64	0	0.000	.26	195
520100	71	0	0.000	.33	213		452	93	66	0	0.000	.30	196
509102	71	0	0.000	.46	214		562	96	62	0	0.100	.28	197
386	96	69	0	0.700	.49	215	404	95	69	0	0.000	.22	198
553100	69	0	0.000	.24	216		400	89	69	0	0.050	.38	199
410	95	69	0	0.150	.43	217	388	84	66	0	0.050	.42	200
425	96	69	0	0.000	.42	218	328	80	66	0	0.450	.28	201
451	96	69	0	0.000	.43	219	482	86	66	0	0.400	.22	202
524	96	68	0	0.000	.30	220	482	93	62	0	0.000	.12	203
553100	69	0	0.000	.30	221		508	95	66	0	0.550	.27	204
539	98	78	0	0.000	.39	222	485	98	68	0	0.000	.41	205
558	98	68	0	0.000	.46	223	441	98	66	0	0.000	.38	206
476100	73	0	0.000	.38	224		532	98	68	0	0.000	.41	207
525	98	75	0	0.000	.30	225	499100	71	0	0.000	.44	208	
473102	71	0	0.000	.34	226		499102	73	0	0.000	.56	209	
446102	69	0	0.100	.29	227		468	96	66	0	0.200	.56	210
264	98	71	0	0.000	.24	228	373	93	69	0	0.000	.32	211
496104	71	0	0.000	.23	229		481	96	69	0	0.000	.27	212
557105	69	0	0.050	.34	230		509	95	64	0	1.200	.50	213
428100	68	0	0.350	.41	231		416	84	64	0	0.400	.22	214
482	96	68	0	0.400	.31	232	306	84	66	0	0.150	.22	215
445	98	69	0	0.000	.18	233	173	78	64	0	0.000	.22	216

Table 1.--*Climatic data in the format of GOSSYM with modifications*--Continued

Parameters[1]

Robles Junction, Ariz., 1973

A	B	C	D	E	F	G
493	100	69	0	0.000	.17	234
470	104	71	0	0.000	.26	235
429	100	69	0	0.000	.35	236
394	98	64	0	0.000	.68	237
400	98	66	0	0.000	.64	238
385	96	64	0	0.000	.64	239
400	98	66	0	0.000	.42	240
400	98	68	0	0.000	.42	241
375	95	62	0	0.000	.41	242
400	98	62	0	0.000	.42	243
450	98	62	0	0.000	.52	244
520	96	62	0	0.000	.63	245
520	98	57	0	0.000	.48	246
438	105	64	0	0.000	.58	247
434	104	69	0	0.000	.58	248
443	104	66	0	0.000	.56	249
464	104	66	0	0.000	.58	250
479	98	71	0	0.000	.89	251
495	96	64	0	0.000	.52	252
486	98	66	0	0.000	.52	253
450	95	60	0	0.000	.62	254
476	96	60	0	0.000	.35	255
458	96	62	0	0.000	.42	256
448	96	64	0	0.000	.27	257
344	91	60	0	0.000	.26	258
440	96	60	0	0.000	.32	259
466	98	59	0	0.000	.38	260
430	100	59	0	0.000	.35	261
433	95	64	0	0.000	.36	262
398	96	62	0	0.000	.36	263
385	95	62	0	0.000	.36	264
361	95	59	0	0.000	.36	265
430	93	62	0	0.000	.40	266
449	89	53	0	0.000	.59	267

Robles Junction, Ariz., 1974

A	B	C	D	E	F	G
300	80	62	0	0.000	.19	217
383	89	69	0	0.000	.10	218
456	95	64	0	0.000	.14	219
520	95	66	0	0.000	.33	220
546	89	68	0	0.000	.42	221
484	93	60	0	0.000	.38	222
530	95	62	0	0.000	.28	223
506	96	62	0	0.000	.26	224
469	95	78	0	0.000	.32	225
371	95	68	0	0.000	.40	226
487	93	64	0	0.000	.40	227
467	96	59	0	0.000	.42	228
494	96	68	0	0.000	.17	229
307	93	68	0	0.000	.26	230
488	89	62	0	0.000	.32	231
533	89	75	0	0.000	.32	232
488	95	68	0	0.000	.38	233
424	64	95	0	0.000	.30	234
475	96	68	0	0.000	.26	235
448	68	98	0	0.000	.32	236
486	93	68	0	0.000	.34	237
499	89	62	0	0.000	.38	238
386	96	68	0	0.000	.38	239
468	95	62	0	0.000	.42	240
502	98	59	0	0.000	.50	241
488	100	60	0	0.000	.50	242
474	100	64	0	0.000	.50	243

Table 1.--*Climatic data in the format of GOSSYM with modifications*--Continued

Parameters[1]

Robles Junction, Ariz., 1976[2]

A	B	C	D	E	F	G
542	82	41	0	0.000	.00	100
592	84	44	0	0.000	.23	101
559	84	42	0	0.000	.36	102
477	78	44	0	0.000	.43	103
395	69	51	0	0.000	.50	104
353	60	44	0	0.250	.26	105
390	57	39	0	0.000	.18	106
217	48	32	0	0.500	.12	107
596	60	30	0	0.000	.02	108
620	71	33	0	0.000	.05	109
583	73	39	0	0.000	.12	110
475	82	41	0	0.000	.16	111
530	87	48	0	0.000	.21	112
492	84	53	0	0.000	.30	113
538	84	46	0	0.000	.45	114
555	86	50	0	0.000	.29	115
493	89	51	0	0.000	.25	116
518	86	51	0	0.000	.32	117
355	84	57	0	0.000	.33	118
520	82	48	0	0.000	.45	119
545	87	46	0	0.000	.33	120
568	89	48	0	0.000	.22	121
589	86	48	0	0.000	.34	122
562	93	48	0	0.000	.31	123
278	89	60	0	0.000	.43	124
233	77	53	0	0.000	.50	125
521	78	42	0	0.000	.14	126
359	77	44	0	0.000	.16	127
499	80	42	0	0.000	.36	128
575	77	42	0	0.000	.42	129
581	87	44	0	0.000	.16	130
550	93	51	0	0.000	.24	131
476	95	53	0	0.000	.32	132
547	95	53	0	0.000	.34	133
560	95	50	0	0.000	.46	134
557	100	53	0	0.000	.38	135
548	98	55	0	0.000	.41	136
532	96	55	0	0.000	.48	137
508	96	55	0	0.000	.39	138
353	91	62	0	0.000	.38	139
189	82	62	0	0.000	.34	140
519	89	62	0	0.000	.32	141
568	91	53	0	0.000	.31	142

Robles Junction, Ariz., 1976[3]

A	B	C	D	E	F	G
542	82	41	0	0.000	.00	100
592	84	44	0	0.000	.23	101
559	84	42	0	0.000	.36	102
477	78	44	0	0.000	.43	103
395	69	51	0	0.000	.50	104
353	60	44	0	0.250	.26	105
390	57	39	0	0.000	.18	106
217	48	32	0	0.500	.12	107
596	60	30	0	0.000	.02	108
620	71	33	0	0.000	.05	109
583	73	39	0	0.000	.12	110
475	82	41	0	0.000	.16	111
530	87	48	0	0.000	.21	112
492	84	53	0	0.000	.30	113
538	84	46	0	0.000	.45	114
555	86	50	0	0.000	.29	115
493	89	51	0	0.000	.25	116
518	86	51	0	0.000	.32	117
355	84	57	0	0.000	.33	118
520	82	48	0	0.000	.45	119
545	87	46	0	0.000	.33	120
568	89	48	0	0.000	.22	121
589	86	48	0	0.000	.34	122
562	93	48	0	0.000	.31	123
278	89	60	0	0.000	.43	124
233	77	53	0	0.000	.50	125
521	78	42	0	0.000	.14	126
359	77	44	0	0.000	.16	127
499	80	42	0	0.000	.36	128
575	77	42	0	0.000	.42	129
581	87	44	0	0.000	.16	130
550	93	51	0	0.000	.24	131
476	95	53	0	0.000	.32	132
547	95	53	0	0.000	.34	133
560	95	50	0	0.000	.46	134
557	100	53	0	0.000	.38	135
548	98	55	0	0.000	.41	136
532	96	55	0	0.000	.48	137
508	96	55	0	0.000	.39	138
353	91	62	0	0.000	.38	139
189	82	62	0	0.000	.34	140
519	89	62	0	0.000	.22	141
568	91	53	0	0.000	.31	142

Table 1.--*Climatic data in the format of GOSSYM with modifications*--Continued

Parameters[1]

Robles Junction, Ariz., 1976[2]							Robles Junction, Ariz., 1976[3]						
A	B	C	D	E	F	G	A	B	C	D	E	F	G
610	89	51	0	0.000	.41	143	610	89	51	0	0.000	.41	143
602	93	50	0	0.000	.32	144	602	93	50	0	0.000	.32	144
546	89	59	0	0.000	.34	145	546	89	59	0	0.000	.34	145
523	87	51	0	0.000	.35	146	523	87	51	0	0.000	.35	146
551	93	51	0	0.000	.30	147	551	93	51	0	0.000	.30	147
544	100	57	0	0.000	.32	148	544	100	57	0	0.000	.32	148
471	93	53	0	0.000	.41	149	471	93	53	0	0.000	.41	149
514	87	57	0	0.000	.38	150	514	87	57	0	0.000	.38	150
587	89	48	0	0.000	.68	151	587	89	48	0	0.000	.68	151
573	95	55	0	0.000	.58	152	573	95	55	0	0.000	.58	152
511	102	59	0	0.000	.34	153	511	102	59	0	0.000	.34	153
524	100	55	0	0.000	.34	154	524	100	55	0	0.000	.34	154
550	101	56	0	0.000	.42	155	550	101	56	0	0.000	.42	155
572	104	57	0	0.000	.54	156	572	104	57	0	0.000	.54	156
531	105	60	0	0.000	.45	157	531	105	60	0	0.000	.45	157
557	102	57	0	0.000	.39	158	557	102	57	0	0.000	.39	158
559	102	53	0	0.000	.46	159	559	102	53	0	0.000	.46	159
494	100	57	0	0.000	.52	160	494	100	57	0	0.000	.52	160
479	96	55	0	0.000	.41	161	479	96	55	0	0.000	.41	161
460	93	44	0	0.000	.56	162	460	93	44	0	0.000	.56	162
570	98	50	0	0.000	.63	163	570	98	50	0	0.000	.63	163
558	102	57	0	0.000	.31	164	558	102	57	0	0.000	.31	164
585	102	50	0	0.000	.40	165	585	102	50	0	0.000	.40	165
594	105	57	0	0.000	.46	166	594	105	57	0	0.000	.46	166
510	98	60	0	0.000	.49	167	510	98	60	0	0.000	.49	167
558	96	66	0	0.000	.42	168	558	96	64	0	0.000	.42	168
549	99	58	0	0.000	.56	169	548	102	63	0	0.000	.50	170
548	103	64	0	0.000	.50	170	549	98	56	0	0.000	.56	169
544	108	64	0	0.000	.44	171	544	107	62	0	0.000	.44	171
520	107	71	0	0.000	.47	172	520	106	69	0	0.000	.47	172
371	103	68	0	0.000	.48	173	371	104	65	0	0.000	.48	173
533	100	60	0	0.000	.44	174	533	100	60	0	0.000	.44	174
551	102	60	0	0.000	.55	175	551	104	59	0	0.000	.55	175
584	105	59	0	0.000	.37	176	584	107	60	0	0.000	.37	176
563	108	59	0	0.000	.44	177	563	109	60	0	0.000	.44	177
559	111	68	0	0.000	.43	178	559	111	68	0	0.000	.43	178
632	107	71	0	0.000	.51	179	632	109	71	0	0.000	.51	179
572	109	73	0	0.000	.48	180	572	109	73	0	0.000	.48	180
489	105	68	0	0.050	.56	181	489	105	68	0	0.050	.56	181
558	106	71	0	0.000	.47	182	558	106	71	0	0.000	.47	182
590	105	68	0	0.000	.36	183	590	105	68	0	0.000	.36	183
582	104	66	0	0.000	.45	184	582	105	66	0	0.000	.45	184
551	98	69	0	0.000	.54	185	551	100	68	0	0.000	.54	185

Table 1.--*Climatic data in the format of GOSSYM with modifications*--Continued

Parameters[1]

Robles Junction, Ariz., 1976[2]							Robles Junction, Ariz., 1976[3]						
A	B	C	D	E	F	G	A	B	C	D	E	F	G
587100	68	0	0.000.43	186			587102	68	0	0.000.43	186		
486 99	65	0	0.000.40	187			486100	64	0	0.000.40	187		
510 99	66	0	0.000.49	188			510102	66	0	0.000.49	188		
535102	63	0	0.000.44	189			535105	62	0	0.000.44	189		
593101	74	0	0.000.46	190			593102	74	0	0.000.46	190		
471100	74	0	0.000.50	191			471102	73	0	0.000.50	191		
529 96	69	0	0.000.53	192			529 96	69	0	0.000.53	192		
491 87	69	0	0.300.34	193			491 88	69	0	0.300.34	193		
308 91	69	0	0.050.26	194			308 92	68	0	0.050.26	194		
334 97	66	0	0.000.05	195			334 98	64	0	0.000.05	195		
464101	66	0	0.050.12	196			464102	66	0	0.050.12	196		
515 98	69	0	0.000.19	197			515100	69	0	0.000.19	197		
371 89	70	0	0.000.29	198			371 89	69	0	0.000.29	198		
450 94	70	0	0.100.12	199			450 95	69	0	0.100.12	199		
415 97	70	0	0.000.09	200			415 98	69	0	0.000.09	200		
445 92	69	0	0.050.18	201			445 93	68	0	0.050.18	201		
359 94	69	0	0.050.17	202			359 95	68	0	0.050.17	202		
386 95	66	0	0.100.16	203			386 96	66	0	0.100.16	203		
350 91	68	0	0.000.10	204			350 92	68	0	0.000.10	204		
398 94	64	0	0.300.13	205			398 95	63	0	0.300.13	205		
526 95	64	0	0.050.09	206			526 96	63	0	0.050.09	206		
404 98	68	0	0.000.18	207			404100	68	0	0.000.18	207		
522 96	68	0	0.000.14	208			522 98	67	0	0.000.14	208		
407 96	68	0	0.250.17	209			407 97	66	0	0.250.17	209		
514 82	69	0	0.000.16	210			514 84	68	0	0.000.16	210		
245 96	68	0	0.100.19	211			245 98	66	0	0.100.19	211		
611 93	62	0	0.000.08	212			611 95	62	0	0.000.08	212		
529 96	62	0	0.000.19	213			529 96	60	0	0.000.19	213		
560 96	61	0	0.000.23	214			560 98	60	0	0.000.23	214		
568 92	64	0	0.000.32	215			568 95	62	0	0.000.32	215		
485 96	60	0	0.000.37	216			485100	59	0	0.000.37	216		
514 98	60	0	0.000.42	217			514102	60	0	0.000.42	217		
538102	62	0	0.000.33	218			538107	64	0	0.000.33	218		
548 99	69	0	0.000.40	219			548103	69	0	0.000.40	219		
400 96	65	0	0.400.42	220			400 95	66	0	0.400.42	220		
358100	64	0	0.000.28	221			358 96	66	0	0.000.28	221		
454 96	66	0	0.000.22	222			454 94	67	0	0.000.22	222		
424100	63	0	0.050.22	223			424 96	64	0	0.050.22	223		
524105	68	0	0.000.21	224			524100	69	0	0.000.21	224		
527106	63	0	0.000.22	225			527100	64	0	0.000.22	225		
449104	60	0	0.000.33	226			449102	62	0	0.000.33	226		
577 95	62	0	0.000.38	227			577 91	62	0	0.000.38	227		
547 93	60	0	0.000.45	228			547 89	62	0	0.000.45	228		

Table 1.--*Climatic data in the format of GOSSYM with modifications*--Continued

Parameters[1]

Robles Junction, Ariz., 1976[2]

A	B	C	D	E	F	G
408	95	60	0	0.000	.32	229
442	95	66	0	0.000	.38	230
502	95	60	0	0.000	.26	231
422	100	59	0	0.000	.31	232
607	102	62	0	0.000	.29	233
476	100	64	0	0.000	.27	234
420	100	69	0	0.150	.30	235
455	96	68	0	0.000	.15	236
478	100	69	0	0.000	.23	237
499	102	64	0	0.000	.37	238
431	104	68	0	0.350	.35	239
554	98	66	0	0.000	.35	240
523	98	68	0	0.000	.36	241
550	198	62	0	0.000	.38	242
556	100	66	0	0.000	.53	243
450	96	71	0	0.000	.45	244
491	96	71	0	0.000	.48	245
293	89	66	0	0.000	.40	246
480	95	62	0	0.050	.26	247
446	95	62	0	0.100	.16	248
328	95	62	0	0.150	.16	249

Robles Junction, Ariz., 1976[3]

A	B	C	D	E	F	G
408	89	62	0	0.000	.32	229
442	91	66	0	0.000	.38	230
502	91	62	0	0.000	.26	231
422	96	59	0	0.000	.31	232
607	98	64	0	0.000	.29	233
476	95	64	0	0.000	.27	234
420	95	69	0	0.150	.30	235
455	95	69	0	0.000	.15	236
478	93	69	0	0.000	.23	237
499	96	66	0	0.000	.37	238
431	100	68	0	0.350	.35	239
554	95	68	0	0.000	.35	240
523	95	68	0	0.000	.36	241
550	95	62	0	0.000	.38	242
556	98	60	0	0.000	.53	243
450	98	66	0	0.000	.45	244
491	95	71	0	0.000	.48	245
293	87	66	0	0.000	.40	246
480	93	64	0	0.050	.26	247
446	93	62	0	0.100	.16	248
328	93	62	0	0.150	.16	249

Table 1.--*Climatic data in the format of GOSSYM with modifications*--Continued

Parameters[1]

Marana, Ariz., 1973							Midvale, Tucson, Ariz., 1974						
A	B	C	D	E	F	G	A	B	C	D	E	F	G
0	84	43	0	0.000.00		102	468	62	44	0	0.000.00		100
0	78	45	0	0.000.00		103	481	69	33	0	0.000.00		101
0	73	45	0	0.000.00		104	509	75	35	0	0.000.00		102
0	71	37	0	0.000.00		105	532	77	35	0	0.000.00		103
0	71	44	0	0.000.00		106	515	80	33	0	0.000.00		104
0	79	41	0	0.000.00		107	530	82	33	0	0.000.00		105
401	68	49	0	0.000.00		108	527	86	35	0	0.000.00		106
509	71	39	0	0.000.00		109	545	86	35	0	0.000.00		107
347	59	45	0	0.000.00		110	472	82	42	0	0.000.00		108
565	71	42	0	0.000.00		111	532	75	50	0	0.000.00		109
558	82	38	0	0.000.00		112	515	77	35	0	0.000.38		110
452	80	44	0	0.000.59		113	532	78	41	0	0.000.36		111
531	80	45	0	0.000.35		114	509	89	37	0	0.000.23		112
565	84	38	0	0.000.61		115	381	86	46	0	0.000.35		113
574	90	49	0	0.000.64		116	399	86	51	0	0.000.48		114
565	93	49	0	0.000.64		117	178	80	55	0	0.000.34		115
584	89	50	0	0.000.44		118	498	82	42	0	0.000.38		116
234	76	54	0	0.001.00		119	442	84	37	0	0.000.36		117
451	75	53	0	0.000.40		120	541	82	42	0	0.000.34		118
486	70	40	0	0.000.32		121	568	84	44	0	0.000.32		119
580	83	41	0	0.000.48		122	536	86	41	0	0.000.37		120
596	91	48	0	0.000.37		123	567	87	41	0	0.000.33		121
490	86	48	0	0.001.01		124	536	87	44	0	0.000.36		122
529	72	52	0	0.400.85		125	526	87	46	0	0.000.48		123
595	72	42	0	0.000.62		126	560	86	46	0	0.000.52		124
574	82	44	0	0.000.56		127	563	86	42	0	0.000.40		125
558	87	51	0	0.000.58		128	533	89	42	0	0.000.33		126
580	92	51	0	0.000.70		129	557	87	48	0	0.000.33		127
580	96	54	0	0.000.79		130	559	84	53	0	0.000.35		128
574	96	56	0	0.000.73		131	524	87	50	0	0.000.39		129
517	94	53	0	0.000.76		132	520	91	50	0	0.000.49		130
548	93	59	0	0.000.69		133	554	95	46	0	0.000.52		131
510	90	57	0	0.000.88		134	539	93	50	0	0.000.26		132
596	89	57	0	0.000.88		135	514	87	57	0	0.000.69		133
550	89	54	0	0.000.86		136	584	89	44	0	0.000.39		134
537	94	56	0	0.000.84		137	583	89	51	0	0.000.57		135
584	97	57	0	0.000.69		138	525	91	53	0	0.000.48		136
522	96	57	0	0.000.84		139	436	84	55	0	0.000.62		137
539	93	56	0	0.000.76		140	509	91	44	0	0.000.60		138
373	90	53	0	0.000.76		141	595	73	51	0	0.000.49		139
548	90	54	0	0.000.80		142	587	75	42	0	0.000.30		140
588	91	54	0	0.000.60		143	604	89	37	0	0.000.35		141
599	92	52	0	0.000.84		144	514	93	48	0	0.000.39		142

Table 1.--*Climatic data in the format of GOSSYM with modifications*--Continued

Parameters[1]

Marana, Ariz., 1973							Midvale, Tucson, Ariz., 1974						
A	B	C	D	E	F	G	A	B	C	D	E	F	G
556	90	53	0	0.000	.74	145	475	96	53	0	0.000	.40	143
595	89	59	0	0.001	.08	146	567	89	48	0	0.000	.55	144
559	92	55	0	0.000	.66	147	559	98	46	0	0.000	.48	145
581	98	53	0	0.000	.72	148	563	104	51	0	0.000	.39	146
491	101	58	0	0.000	.88	149	556	102	53	0	0.000	.44	147
545	100	65	0	0.001	.00	150	561	95	59	0	0.000	.62	148
432	88	69	0	0.000	.95	151	579	95	48	0	0.000	.57	149
614	89	57	0	0.000	.51	152	494	91	46	0	0.000	.54	150
575	87	54	0	0.000	.72	153	596	98	48	0	0.000	.54	151
608	91	55	0	0.000	.68	154	609	96	44	0	0.000	.48	152
637	92	52	0	0.000	.83	155	587	96	50	0	0.000	.48	153
586	100	57	0	0.000	.78	156	614	95	48	0	0.000	.49	154
523	103	60	0	0.000	.84	157	601	95	50	0	0.000	.50	155
608	104	62	0	0.000	.65	158	569	95	50	0	0.000	.48	156
629	104	65	0	0.000	.74	159	551	95	50	0	0.000	.38	157
611	104	67	0	0.000	.84	160	521	91	68	0	0.000	.81	158
518	100	67	0	0.000	.79	161	589	89	60	0	0.001	.20	159
490	98	65	0	0.000	.58	162	583	96	55	0	0.000	.48	160
94	80	62	0	0.000	.60	163	582	104	53	0	0.000	.62	161
302	78	60	0	0.000	.22	164	588	104	57	0	0.000	.62	162
641	90	58	0	0.280	.22	165	600	105	59	0	0.000	.50	163
643	88	56	0	0.000	.22	166	542	105	62	0	0.000	.58	164
640	92	50	0	0.000	.52	167	565	105	68	0	0.000	.94	165
622	96	54	0	0.000	.47	168	508	107	69	0	0.001	.21	166
580	94	56	0	0.000	.48	169	539	105	68	0	0.000	.92	167
544	96	61	0	0.000	.68	170	504	105	60	0	0.000	.92	168
590	103	54	0	0.000	.76	171	504	107	60	0	0.000	.92	169
613	102	75	0	0.000	.40	172	490	107	66	0	0.000	.92	170
617	101	64	0	0.000	.69	173	482	105	66	0	0.020	.92	171
626	100	64	0	0.000	.65	174	554	105	66	0	0.000	.92	172
599	104	64	0	0.000	.80	175	565	107	64	0	0.000	.82	173
581	104	69	0	0.000	.66	176	499	111	68	0	0.000	.96	174
571	105	70	0	0.000	.80	177	508	104	75	0	0.000	.64	175
571	107	70	0	0.000	.70	178	506	104	69	0	0.000	.65	176
575	110	72	0	0.000	.76	179	582	105	73	0	0.000	.64	177
562	104	73	0	0.000	.61	180	494	107	71	0	0.000	.74	178
510	103	73	0	0.000	.66	181	535	107	68	0	0.000	.70	179
526	105	69	0	0.000	.64	182	547	104	69	0	0.010	.74	180
479	108	73	0	0.000	.72	183	554	102	73	0	0.000	.71	181
517	106	75	0	0.000	.82	184	426	102	66	0	0.120	.68	182
572	105	74	0	0.000	.66	185	478	95	69	0	0.050	.39	183
562	108	80	0	0.000	.68	186	591	95	68	0	0.000	.30	184
551	102	76	0	0.000	.69	187	470	100	66	0	0.000	.38	185

Table 1.--*Climatic data in the format of GOSSYM with modifications*--Continued

Parameters[1]						
Marana, Ariz., 1973						
A	B	C	D	E	F	G
516	81	74	0	0.000	.54	188
475	104	71	0	0.000	.50	189
545	102	70	0	0.000	.46	190
462	102	78	0	0.000	.46	191
329	98	76	0	0.000	.44	192
328	96	72	0	0.000	.32	193
416	95	71	0	0.000	.26	194
389	94	68	0	0.150	.28	195
457	92	67	0	0.040	.28	196
433	86	67	0	0.000	.24	197
418	92	64	0	0.000	.25	198
517	96	65	0	0.000	.30	199
553	102	68	0	0.000	.42	200
571	104	66	0	0.000	.47	201
600	101	64	0	0.000	.51	202
601	100	58	0	0.000	.69	203
582	100	59	0	0.000	.48	204
584	103	58	0	0.000	.60	205
584	102	60	0	0.000	.49	206
577	100	70	0	0.000	.43	207
326	97	70	0	0.000	.46	208
542	98	70	0	0.000	.36	209
448	96	68	0	0.100	.35	210
509	92	68	0	0.000	.32	211
541	96	70	0	0.000	.45	212
533	102	74	0	0.000	.58	213
508	104	73	0	0.000	.46	214
402	100	72	0	0.000	.82	215
493	100	70	0	0.460	.32	216
440	98	67	0	0.000	.36	217
441	95	68	0	0.000	.40	218
538	96	68	0	0.000	.52	219
523	96	66	0	0.000	.54	220
543	96	65	0	0.000	.44	221
557	94	71	0	0.000	.52	222
530	98	68	0	0.000	.65	223
455	104	73	0	0.000	.64	224
509	100	72	0	0.000	.62	225
508	99	70	0	0.000	.54	226
453	100	71	0	0.000	.42	227
248	91	73	0	0.200	.62	228
499	102	68	0	0.000	.28	229
518	103	68	0	0.000	.54	230

Midvale, Tucson, Ariz., 1974						
A	B	C	D	E	F	G
511	100	73	0	0.000	.50	186
366	93	71	0	0.000	.36	187
358	86	66	0	0.160	.33	188
528	93	66	0	0.000	.20	189
580	95	60	0	0.000	.50	190
597	96	59	0	0.000	.47	191
568	96	59	0	0.000	.51	192
421	95	68	0	0.000	.74	193
421	96	69	0	0.000	.66	194
439	91	66	0	0.000	.24	195
452	95	68	0	0.000	.25	196
562	96	62	0	0.000	.36	197
416	95	69	0	0.020	.58	198
416	93	68	0	0.060	.36	199
400	86	68	0	0.030	.38	200
316	78	66	0	0.120	.24	201
441	87	64	0	0.020	.14	202
482	95	62	0	0.000	.25	203
508	95	66	0	0.000	.26	204
485	98	66	0	0.000	.41	205
410	102	66	0	0.000	.52	206
524	100	66	0	0.000	.45	207
526	100	71	0	0.000	.80	208
512	100	73	0	0.000	.51	209
407	96	66	0	0.030	.51	210
401	93	69	0	0.000	.43	211
458	96	69	0	0.000	.18	212
439	96	62	0	0.000	.50	213
416	84	64	0	0.100	.60	214
306	84	66	0	0.000	.13	215
173	78	64	0	0.000	.28	216
300	80	62	0	0.030	.08	217
383	89	69	0	0.000	.10	218
456	95	66	0	0.030	.22	219
395	95	66	0	0.000	.20	220
493	98	68	0	0.000	.30	221
511	100	64	0	0.000	.26	222
446	100	60	0	0.000	.28	223
529	100	60	0	0.000	.26	224
500	102	68	0	0.000	.31	225
445	102	71	0	0.000	.27	226
432	100	68	0	0.000	.28	227
448	102	69	0	0.000	.30	228

Table 1.--*Climatic data in the format of GOSSYM with modifications*--Continued

Parameters[1]

Marana, Ariz., 1973							Midvale, Tucson, Ariz., 1974						
A	B	C	D	E	F	G	A	B	C	D	E	F	G
501	100	66	0	0.05	0.36	232	471	104	66	0	0.00	0.17	229
505	99	70	0	0.00	0.58	233	281	98	68	0	0.00	0.26	230
481	102	69	0	0.00	0.38	234	455	98	66	0	0.00	0.31	231
472	107	71	0	0.00	0.48	235	501	93	71	0	0.00	0.31	232
494	102	69	0	0.00	0.64	236	476	98	64	0	0.00	0.33	233
457	98	64	0	0.00	0.71	237	498	98	62	0	0.00	0.31	234
464	100	65	0	0.00	0.70	238	461	98	68	0	0.00	0.31	235
474	101	64	0	0.00	0.70	239	482	98	62	0	0.00	0.31	236
491	96	66	0	0.00	0.34	240	479	98	68	0	0.00	0.33	237
433	99	68	0	0.00	0.44	241	506	100	62	0	0.00	0.36	238
404	100	67	0	0.00	0.40	242	506	100	60	0	0.00	0.36	239
400	96	63	0	0.00	0.36	243	510	100	60	0	0.00	0.31	240
476	98	62	0	0.00	0.38	244	462	102	57	0	0.00	0.27	241
486	97	58	0	0.00	0.54	245	469	104	57	0	0.00	0.27	242
434	99	58	0	0.00	0.58	246	460	104	59	0	0.00	0.22	243
476	103	62	0	0.00	0.59	247							
429	103	65	0	0.00	0.69	248							
431	106	63	0	0.00	0.60	249							
456	106	65	0	0.00	0.61	250							
473	100	61	0	0.00	0.44	251							
461	94	60	0	0.00	0.52	252							
469	98	62	0	0.00	0.26	253							
466	96	57	0	0.00	0.40	254							
469	96	59	0	0.00	0.44	255							
461	94	62	0	0.00	0.38	256							
481	98	62	0	0.00	0.39	257							
295	98	62	0	0.00	0.44	258							
421	98	68	0	0.00	0.28	259							
440	100	60	0	0.00	0.38	260							
410	100	59	0	0.00	0.45	261							

[1]Parameters:
A, columns 1-3, radiation (Langleys per day).
B, columns 4-6, maximum temperature (degrees Fahrenheit).
C, columns 7-9, minimum temperature (degrees Fahrenheit).
D, columns 10-11, water application methods: 0, rain or sprinkler irrigation; 1, irrigation in row.
E, columns 12-16, rain (inches).
F, columns 17-20, pan evaporation (inches).
G, columns 21-24, Julian day.
[2]Plant density, 29,100 per acre.
[3]Plant density, 10,400 per acre.

Table 2.--*Tensiometer readings, Robles Junction, Ariz., 1976*

Date			10,400 plants per acre				29,100 plants per acre			
			Depth (inches)				Depth (inches)			
Gregorian		Julian	6	12	18	36	6	12	24	36
Apr.	11	102					32	24		
	12	103					32	26		
	13	104					33	28		
	15	106					30	34		
	16	107					24	34		
	17	108					22	30		
	19	110					25	24		
	22	113					28	26		
	23	114					29	27		
	24	115					30	28		
	25	116					34	31		
	26	117					32	30		
	27	118					34	32		
	28	119					35	32		
	29	120					36	35		
	30	121					36	34		
May	1	122					38	36		
	3	124					46	38		
	5	126					40	40		
	7	128					46	42		
	10	131					45	41		
	12	133					50	42		
	14	135					54	44		
	15	136[1]								
	17	138					4	10		
	19	140	11	10			10	12		
	22	143	20	16			18	14		
	24	145	22	18			20	17		
	26	147	26	20			24	18		
	28	149	30	22			26	20		
	31	152	37	26			34	32		
June	2	154	40	27			40	25		
	4	156	50	30			54	30		
	7	159	66	34			64	36		
	9	161	64	38			61	44		
	11	163	62	44			54	56		
	16	168[1]								
	18	170		7			2	10		
	19	171		12			0	12		
	21	173		14		18	0	16	9	14
	23	175		19	17	19	2	22	12	15
	25	177		22	18	20	13	28	14	16
	28	180		32	23	22	14	46	24	16
	30	182		46	25	22	16	66	45	16

Table 2.--*Tensiometer readings, Robles Junction, Ariz., 1976*--Continued

Date			10,400 plants per acre				29,100 plants per acre			
			Depth (inches)				Depth (inches)			
Gregorian		Julian	6	12	18	36	6	12	24	36
July	2	184		66	27	25		79	66	20
	5	187[1]		2	10	28		5	3	8
	7	189		14	16	18		14	8	12
	9	191		20	18	22		19	10	15
	14	196		48	33	27		33	22	24
	16	198		68	54	32		44	45	32
	19	201		78	77	34		58	61	42
	21	203		81	86	38		70	68	51
	23	205		82	87	42		77	72	58
	26	208		64	2	52		80	71	76
	28	210[1]			2	65		82	59	80
	31	213			1	74		84	-	83
Aug.	2	215			2	78		12	0	16
	4	217			2	78		17	8	20
	6	219			5	67		22	12	28
	9	222			8	72		36	20	45
	11	224				54		50	29	60
	13	226				45		72	-	73
	14	227								
	16	229						10	64	80
	21	234						24		54
	23	236						33		54
	27	240						70		40
	30	243						83		22
Sept.	1	245[1]								

[1] Irrigated every other row.

Table 3.--*Cotton (Deltapine 16) plant*

Date	Plant height[1]	No. stem nodes	Leaf area (cm^2)[1]	No. of squares: Diameter (mm) ph[2]	1-2	3-4	5-6	7-8	9-10	11-12	Total[1]	No. of blooms[1]
												Robles Junction, 1973.
June 20	22.9	12.5±1.0		1.3	0.7	0.6	0.2				2.6±1.8	
26	27.4	14.4±1.1		1.3	.3	.9	.9	0.2			3.6±2.3	
July 3	36.7	16.6±1.2		2.0	1.6	1.6	.8	1.0	0.4	0.4	7.7±4.1	0.1±0.3
10	60.0	18.6±2.6		3.0	2.4	3.3	2.1	1.2	.5	.3	12.9±7.4	.2± .4
17	55.0	18.9±4.8		3.2	2.8	2.7	3.2	2.6	.9	.3	16.5±7.4	.2± .4
24	77.3	22.2±2.5		3.1	2.6	3.0	3.2	4.6	1.7	.7	17.1±7.5	.3± .5
31	84.8	22.4±6.1		5.4	2.5	1.2	1.4	3.2	1.6	1.4	14.7±7.2	.5± .6
Aug. 7	89.7	23.2±6.5		5.4	2.7	2.2	2.4	2.3	1.4	.5	16.6±8.3	.9± .9
28	85.9	21.2±7.0		1.6	.2						1.7±2.6	
Sept.25		26.1±1.5										
												Robles Junction, 1974.
June 12	23.1			4.9	9	1.2	.6				7.4±2.4	
18	30.4			3.2	3.0	2.3	1.0	.8			10.1±3.4	
25	43.5			4.1	2.8	3.2	2.6	2.0	1.2	.4	16.3±5.1	
July 4	55.0			4.6	2.7	2.7	3.2	2.6	2.0	1.4	19.1±6.1	
9	71.9			4.4	2.4	3.1	4.1	4.0	2.1	1.6	21.5±6.5	
16	85.7			5.2	1.2	1.6	2.9	3.5	2.1	2.1	18.5±4.7	
25	90.2			4.5	.5	.7	1.8	2.4	2.2	2.6	14.6±5.6	
Aug. 6	93.2			6.0	.3	.5	.9	1.1	1.1	.8	10.9±3.5	
13	98.3			4.8	1.1	.9	1.0	.7	.7	.4	9.7±2.8	
20	97.5			.5	.7	.3	.7	.5	.5	.3	3.4±2.0	
												Robles Junction, 1976.
June 2	6.1± 1.8	5.1±1.4	58± 37									
7	9.3± 1.6	8.4±1.4	138± 56	.6	.2	.1					.9± 1.0	
14	14.3± 2.4	11.6±1.1	322± 96	2.8	2.8	1.2	.4				5.7± 2.7	
21	21.8± 3.4	13.2±2.8	656± 191	4.3	3.3	3.2	1.5	.9	.0		12.6± 4.4	
28	29.3± 5.3	16.5±1.2	1063± 304	9.2	5.4	4.1	3.3	2.1	.7	.4	25.3± 9.1	.2 ± .4
July 5	38.8± 5.3	18.4±1.3	1644± 612	10.7	5.6	4.4	5.3	4.8	2.0	.9	33.7±11.8	.3 ± .5
13	50.4± 6.0	21.5±1.6	2802± 779	11.2	9.2	8.0	7.7	7.4	4.9	3.8	52.3±14.1	1.5 ±1.0
20	58.8± 6.9	22.4±1.1	3825±1218	14.5	5.3	5.4	8.1	11.8	3.8	3.0	51.9±17.4	1.1 ± .9
26	70.9± 9.2	22.5±5.5	4888±1527	12.4	4.8	4.9	6.5	11.8	6.6	4.0	50.6±17.4	2.6 ±1.9
Aug. 2	77.9±10.6	24.8±1.8	5081±2086	10.6	2.8	2.8	4.2	10.8	6.6	4.4	42.2±20.5	2.5 ±1.7
9	79.4± 8.8	25.7±1.7	5427±1918	8.2	2.6	2.4	3.5	6.4	5.1	4.0	32.3±16.7	3.1 ±2.0
16	88.9±10.0	25.8±1.4	6049±1741	6.3	.9	.9	2.7	5.5	3.1	3.1	22.9±11.6	2.4 ±1.7
23	87.9± 8.6	25.4±3.6	6481±2202	2.3	.6	.2	.5	2.0	1.6	2.1	8.9±13.5	.9 ±1.4
30	89.4± 8.7	25.8±4.1	6290±1592	.2			.1	.4	.5	.4	1.7± 4.3	.4 ± .6
Sept. 6	88.3± 9.4	26.6±1.4	5542±1808						.1	.1	.3± 1.5	.1 ± .4
												Robles Junction, 1976.
June 2	9.0± 1.2	6.3± .9	92± 22									
7	9.2± 1.9	8.4±1.3	111± 39	.6							.7± .8	
14	15.9± 2.1	11.0±2.0	303± 96	2.6	1.8	1.3	.4				6.1± 2.6	
21	24.1± 3.7	13.4±2.9	595± 193	5.9	2.8	3.0	1.7	1.0	.1		13.4± 4.4	
28	33.8± 4.6	15.4±2.1	880± 325	7.2	4.3	3.1	2.9	1.4	.7	.5	19.7± 5.2	.2 ± .4
July 5	44.0± 5.3	16.9±2.8	1285± 432	9.5	3.9	2.5	3.7	4.0	2.1	1.0	25.2± 7.1	.3 ± .5
13	54.3± 5.4	20.2±2.4	2292± 702	9.4	5.0	4.1	5.1	6.6	2.4	2.6	35.3±10.1	.9 ± .7
20	63.1± 8.2	21.4±1.7	2886±1064	11.2	3.4	3.8	5.1	8.7	2.4	1.3	35.9±13.1	1.5 ±1.1
26	76.3± 8.2	23.6±1.0	3516±1035	10.8	2.0	2.6	4.0	8.2	4.0	1.9	33.5±11.7	1.2 ±1.2
Aug. 2	78.1± 8.5	22.7±3.9	3203± 933	4.9	1.0	.7	1.6	5.6	3.9	1.2	18.8± 8.0	1.9 ±1.1
9	77.5± 7.8	24.7±1.6	3096± 876	4.2	.8	.8	.9	2.6	2.3	2.1	14.0± 8.2	2.0 ±1.4
16	86.6± 9.8	23.8±3.7	3023± 963	4.4	.7	.8	1.6	3.6	1.6	.9	13.6± 9.7	.8 ± .8

No. of bolls													
Diameter (mm)												No. blank fruiting nodes[1]	Total No. fruiting nodes[1]
To 12	13-15	16-18	19-21	22-24	25-27	28-30	31-33	34-36	>36	Open	Total[1]		
Plant density: 42,100 per acre													
												2.8± 2.1	5.3± 2.4
												6.2± 2.7	9.8± 3.3
0.2											0.2±0.5	10.7± 4.1	18.6± 5.2
.4	0.3										1.0± .9	11.7± 6.4	25.6±12.4
1.2	.2	0.1	0.2	0.1	0.1	0.1					1.9±1.8	12.2± 6.3	30.7±12.3
1.3	.2	.3	.1		.2	.3	0.2				2.6±2.0	22.2± 8.9	43.3±17.2
1.9	.9	.6	.6	.4	.4	.3	.3	0.2			5.5±2.7	24.4± 8.7	45.1±12.0
4.4	1.2	.6	1.0	.6	.9	.8	1.1	.4			10.9±4.3	26.8±10.6	56.6±17.7
.1		.1	.3	.5	.9	1.7	3.0	.6		0.3	7.6±1.9	35.5±11.9	47.1± 9.7
										10.6	10.6±2.9	15.1± 8.9	25.3± 9.3
Plant density: 59,200 per acre													
												1.4 ± 1.2	8.8± 1.9
												.8 ± 1.0	11.0± 3.6
.03											.03±.2	2.6 ± 1.9	18.9± 5.6
1.2	.9	.4	.4	.2	.3						3.2±2.0	1.7± 2.1	23.9± 7.2
1.8	.6	.5	.6	.3	.4	.2					4.4±2.3	3.6± 2.5	29.5± 9.1
2.5	1.2	.6	.5	.2	.6	.4	.8	.1			6.0±2.4	6.2± 2.4	31.6± 7.6
2.4	1.2	.9	1.1	.5	.8	.6	1.5	.9			10.0±4.2	13.3± 5.2	38.2±11.1
2.4	1.0	1.2	.6	.7	.6	1.6	4.1	.4			12.6±4.7	19.0± 8.3	42.4±11.7
1.4	.4	.7	.6	.6	.8	3.0	3.3	.3			11.1±4.9	20.9±10.3	42.0±13.5
1.5	.3	.5	.2	.3	.8	3.9	2.7	.1			10.2±4.5	20.7± 7.0	34.3± 8.8
Plant density: 10,400 per acre													
												1.4± 1.4	7.1± 2.6
												3.3± 2.3	15.9± 4.2
.1											.1± .3	7.1± 4.5	32.6±10.8
.7	.3	.3	.1								1.3± 1.3	7.8± 4.1	43.1±14.4
.9	.9	.5	.5	.3	.4	.2	.2				4.0± 2.8	10.1± 5.1	67.8±17.5
3.7	1.5	1.6	1.1	.6	.7	.8	.6	.4			10.9± 6.0	10.8± 5.7	74.9±22.2
3.6	2.9	2.7	1.2	1.2	1.2	1.4	1.5	1.1	.1		17.0± 9.0	16.2± 5.8	86.5±25.0
4.6	2.8	2.5	1.4	1.9	2.3	2.4	2.7	2.1	.1		23.0± 9.1	19.2± 8.7	86.9±31.7
3.5	4.6	3.6	2.5	2.4	1.9	3.2	5.2	5.3	.2		32.4± 9.1	14.2± 8.0	86.6±29.0
5.4	3.0	3.3	1.9	2.4	2.4	3.7	5.4	11.6	.8		39.9±14.3	36.3±14.4	101.4±28.7
2.2	2.4	2.6	1.6	1.3	1.3	2.3	5.1	14.7	2.5	.3	36.4±13.0	41.2±16.5	87.3±30.5
2.5	1.4	1.8	1.4	.6	.6	1.7	4.0	20.9	2.9	.7	38.8±11.4	42.0±14.8	82.8±23.3
.3	.3	.9	.8	.2	.2	.8	3.2	20.9	.8	3.1	31.5± 8.8	48.0±18.3	82.2±23.6
Plant density: 29,100 per acre													
													.6± .7
												1.2± 1.1	7.2± 2.6
												3.6± 2.8	17.1± 5.6
.1											.1± .3	5.2± 2.4	25.2± 5.4
.9	.5	.2	.1								1.7± 1.2	5.1± 3.0	32.2± 9.4
1.4	.8	.6	.4	.5	.3	.5	.1				4.5± 3.5	7.7± 4.4	48.3±13.2
3.0	1.1	1.5	.6	.5	.6	.6	.5	.2			8.5± 5.5	8.7± 5.0	54.6±18.9
2.2	3.1	1.7	.5	.6	1.4	1.3	1.7	1.0	.1		13.5± 6.3	14.6± 5.4	63.0±16.5
2.5	2.1	1.4	.8	1.4	1.7	1.4	1.3	2.4	.1		14.7± 6.8	14.7± 4.1	50.8±14.1
3.0	2.0	2.0	1.5	1.2	1.4	2.6	3.9	2.7			19.9± 9.2	21.6± 8.9	57.2±18.7
1.9	1.6	1.4	.4	.3	1.4	1.1	2.1	5.8	.5		16.6± 7.4	23.9±10.7	55.0±16.4

Table 3.--*Cotton (Deltapine 16) plant*

Date	Plant height[1]	No. stem nodes	Leaf area (cm^2)[1]	No. of squares: Diameter (mm): pH[2]	1-2	3-4	5-6	7-8	9-10	11-12	Total[1]	No. of blooms[1]
Robles Junction, 1976.												
Aug. 23	76.7± 8.2	23.6±1.9	3459±1165	0.2	0.1			0.4	0.4	0.4	1.5± 3.2	0.3 ±0.7
30	82.1± 8.1	24.4±1.1	3247± 754	.4	.1	0.1	0.2	.3	.1	.2	1.5± 6.0	.2 ± .6
Sept. 6	81.9± 5.9	24.3±1.5	3218± 855	.3	.1	.1	.3				.8± 2.6	.03± .2
Marana, 1973.												
June 11	18.9	11.4±1.1		2.0	.5	.1					2.6± 1.6	
19	24.3	13.0±1.1		.8	.2	.1					1.0± 1.0	
25	30.6	15.2± .9		2.2	.9	.9	.5	.2			4.6± 3.1	
July 2	42.6	17.0±1.9		2.5	1.6	2.1	1.6	.9	.1		9.8± 4.3	
9	46.7	20.0±1.7		3.6	4.2	5.9	4.7	2.8	.7	.3	22.0± 8.5	.3 ± .5
18	60.7	23.8±2.6		6.2	4.5	7.0	6.4	6.0	3.1	.8	33.2±14.3	.4 ± .5
23	66.9	24.9±3.1		6.9	3.2	7.7	6.3	7.6	3.1	1.4	36.6±17.1	.8 ±1.2
30	77.0	25.4±2.9		6.8	3.1	5.3	6.8	7.8	4.7	1.2	35.3± 6.9	1.9 ±1.4
Aug. 6	82.1	25.4±2.6		5.8	1.1	.4	1.3	4.4	3.2	1.7	18.0±13.1	1.2 ± .9
13	75.7	24.4±5.0		4.0	.3			.7	.7	1.0	6.7± 7.6	.6 ± .8
21	76.1	25.9±2.1		1.9					.1		3.0± 3.2	.1 ± .3
Sept.27		25.5±4.6										
Midvale, 1974.												
June 17	22.8			2.9	.8	.3	.2				4.2± 1.9	
24	27.6			2.5	1.9	1.5	.9	.1	.1		7.1± 3.3	
July 1	40.3			3.5	2.6	2.6	1.9	1.8	.6	.3	13.2± 4.2	
10	67.6			6.0	3.2	4.0	4.6	4.1	2.0	1.3	25.2±10.0	
15	72.2			5.6	2.1	3.1	3.7	3.9	1.7	1.0	21.6±11.2	
22	87.3			4.4	1.4	1.7	2.2	2.6	1.0	1.0	14.3± 7.3	
Aug. 1	102.6			5.9	1.4	2.0	1.9	2.2	1.1	.6	15.4± 3.9	
5	102.1			8.3	1.6	2.0	2.7	2.0	.9	.6	18.1±11.0	
12	117.6			6.3	1.4	1.4	1.2	1.5	.7	1.0	13.5± 4.5	

[1]Mean ± standard deviation.
[2]Pinhead squares.
[3]Blooms considered as bolls in "To 12" category.
[4]Stoneville 213.

growth data. Arizona. 1973-1976--Continued

No. of bolls													
Diameter (mm)												No. blank fruiting nodes[1]	Total No. fruiting nodes[1]
To 12	13-15	16-18	19-21	22-24	25-27	28-30	31-33	34-36	>36	Open	Total[1]		
Plant density: 29,100 per acre													
0.8	1.0	1.2	0.7	0.2	0.2	0.9	2.3	8.3	1.9	0.3	17.7± 6.4	29.6±12.3	49.1±17.4
.6	.5	.8	.4	.1	.4	1.0	1.9	10.5	.6	.6	17.5± 4.4	26.6± 8.3	45.8±10.5
.1	.4	.4	.3	.1	.3	.6	.9	9.0	.8	2.1	15.1± 4.7	28.1± 8.9	44.1±12.5
Plant density: 15,500 per acre[4]													
												2.1± 1.2	4.7± 2.0
												5.9± 2.7	6.9± 2.8
												8.6± 3.2	13.3± 4.8
												10.2± 4.0	20.0± 5.2
.3											.3± .5	14.8± 6.6	36.8±13.2
1.1	.3	.3	.3	.3		.1	.1				2.5± 2.5	24.5± 9.0	60.2±20.6
1.9	.5	.6	.6	.3	.2	.2	.1	.1			4.4± 2.4	22.8± 7.5	64.5±21.9
3.9	1.5	1.3	.7	.8	.9	1.2	.6	.1			11.2± 5.6	27.5±12.7	75.4±27.6
6.2	1.4	1.5	1.6	1.3	1.6	2.4	2.8	.9			19.6± 5.3	36.5±11.4	68.7±20.7
4.1	1.9	2.2	1.3	.7	1.7	3.5	2.6	.7			18.7± 5.0	37.2± 9.5	62.2±14.4
1.1	.3	.3	.6	1.3	2.1	4.8	4.7	.9	.2		16.1± 4.8	47.9±20.5	67.0±24.5
										15.3	15.3± 5.0	14.0± 8.8	28.9± 8.4
Plant density: 79,800 per acre													
												1.5± 1.1	5.7± 2.5
												2.8± 1.7	9.9± 3.9
.2	.2										.4± .6	3.6± 1.8	17.2± 4.8
.7	.2	.1	.1		.1						1.2± 1.2	5.6± 3.2	32.1±12.8
1.1	.3	.2	.1		.1	.1	.1				2.0± 1.6	6.9± 2.8	30.6±13.4
1.9	.2	.5	.3	.1	.2	.1		.1			3.2± 2.1	9.6± 4.2	27.1±11.8
2.3	.5	.3	.4	.2	.3	.4	.3	.1			4.8± 2.1	13.2± 3.2	33.1± 6.8
1.4	.5	.5	.3	.4	.5	.8	.7	.3			5.2± 3.6	20.6± 8.2	43.9±19.9
1.3	.6	.1	.1	.3	.5	1.2	.3				4.4± 2.5	20.7± 6.5	38.6±10.2

Table 4.--*Weights of plant parts and total plants (Deltapine 16)*

Date	Weight[1] of plant parts (grams)					
	Leaves	Stems and roots	Squares	Bolls	Total fruit	Total plant
Robles Junction, 1973. Plant density: 42,100 per acre						
June 20	2.4(1.5- 3.5)[2]	1.4(0.9- 2.0)	0.01(0 -0.1)		0.01(0 - 0.1)	3.9(2.3- 5.6)
July 3	6.4(4.2- 8.9)[2]	4.8(3.0- 6.9)	.2 (0 - .8)	0.1 (0 - 0.6)	.3 (0 - 1.5)	11.4(7.2- 15.6)
17	9.2(5.3-17.2)[2]	9.4(4.2- 16.7)	.6 (.1 -1.3)	.8 (0 - 4.3)	1.4 (.2 - 5.1)	20.0(9.7- 37.6)
31	17.6(8.4-24.0)[2]	20.3(11.9- 26.9)	1.3 (.5 -2.3)	5.1 (.3-14.4)	6.4 (1.3 -15.1)	44.3(23.1- 60.3)
Aug. 28	16.5(12.6-21.7)[2]	20.9(15.2- 29.7)	.01(0 - .1)	27.6 (12.5-41.4)	27.6 (12.6 -41.4)	65.0(43.3- 92.6)
Robles Junction, 1974. Plant density: 59,200 per acre						
June 12	2.7(1.7- 4.2)	1.5(1.0- 2.4)	.1 (.01- .2)			4.3(2.7- 6.8)
18	4.1(2.0- 7.4)	2.4(1.2- 4.0)	.3 (.1 - .7)			6.8(3.3- 11.5)
25	9.1(6.1-16.2)[3]	16.2(9.5- 23.0)[4]	.8 (.4 -1.8)	.2 (0 - .2)	1.0 (.4 - 1.3)	17.2(11.7- 24.8)
July 4	9.2(6.0-13.4)[3]	16.7(10.3- 25.6)[4]	1.0 (.3 -2.2)	1.3 (.1- 3.0)	2.3 (.4 - 4.5)	19.0(10.7- 30.7)
9	13.3(10.9-14.9)[3]	25.6(17.0- 39.6)[4]	1.4 (.5 -2.5)	1.8 (.3- 4.7)	3.2 (1.0 - 6.2)	28.8(15.4- 43.2)
16	13.2(11.5-14.6)[3]	31.3(21.3- 46.7)[4]	1.3 (.4 -2.4)	4.3 (1.2-11.6)	5.6 (2.0 -13.1)	36.9(24.3- 56.2)
25	24.4(18.3-26.8)[3]	43.4(23.7- 77.2)[4]	1.5 (.6 -4.7)	10.8 (1.3-22.4)	12.3 (2.2 -27.1)	55.7(27.7- 86.6)
Aug. 6	23.4(19.5-29.6)[3]	48.3(29.2- 85.9)[4]	.6 (.2 -1.4)	22.0 (4.4-55.1)	22.6 (4.8 -55.5)	71.0(34.1-131.5)
13	23.8(13.9-41.0)[3]	51.5(28.2-116.2)[4]	.5 (.1 -1.1)	26.6 (8.9-83.6)	27.1 (9.2 -84.5)	78.6(37.3-200.7)
20	25.8(17.0-35.8)[3]	46.3(33.2- 78.6)[4]	.3 (.1 - .8)	31.9 (7.2-68.9)	32.2 (7.6 -68.9)	78.6(47.9-139.2)
Marana, 1973. Plant density: 15,500 per acre[5]						
June 19	4.0(1.6- 6.2)	2.5(1.6- 3.9)	<.01			6.5(4.0- 9.4)
July 2	7.5(4.6-11.9)	6.0(3.3- 9.0)	.2 (0 - .5)	.01(0 - .2)	.2 (0 - .7)	13.6(8.2- 21.0)
18	18.5(12.5-33.2)	17.2(11.5- 32.4)	1.5 (.7 -2.6)	1.5 (0 - 5.5)	3.0 (.7 - 7.7)	38.6(24.9- 69.5)
30	26.7(14.4-44.4)	28.2(13.7- 44.3)	1.9 (.5 -3.7)	8.1 (1.3-19.9)	10.0 (2.5 -20.6)	65.0(30.3- 99.1)
Aug. 13	23.8(15.8-36.5)	28.0(18.6- 39.2)	.4 (0 -1.6)	27.6 (11.8-49.8)	28.0 (11.8 -49.8)	79.8(48.1-125.5)
Tucson, 1974. Plant density: 79,800 per acre						
June 17	2.3(1.3- 3.9)	1.4(.9- 2.5)	.04(.01- .2)			3.8(2.4- 6.5)
24	3.7(1.5- 6.8)	2.4(1.2- 3.9)	.1 (.01- .4)			6.3(2.7- 11.0)
July 1	6.7(5.9- 7.2)[3]	11.4(8.0- 16.7)[4]	.5 (.1 -1.0)	.3 (0 - .5)	.8 (.1 - 1.3)	12.2(8.2- 17.3)
10	13.0(8.7-17.4)[3]	26.1(15.3- 54.3)[4]	1.2 (.4 -2.5)	.7 (0 3.7)	1.9 (.4 - 5.7)	27.9(17.5- 60.0)
15	14.1(25.3- 9.6)[3]	24.4(5.8- 54.1)[4]	.9 (.02-2.7)	1.0 (0 - 5.1)	1.9 (.02- 7.8)	25.3(5.8- 48.5)
22	16.9(13.3-20.2)[3]	28.4(17.3- 67.6)[4]	.9 (.1 -3.0)	1.5 (0 - 7.1)	2.4 (.1 - 8.4)	30.8(14.4- 72.6)
Aug. 1	20.4(14.9-27.6)[3]	34.5(21.7- 50.1)[4]	.6 (.2 -1.3)	3.3 (0 - 8.4)	3.9 (.4 - 9.7)	38.5(22.1- 73.9)
5	21.6(12.4-49.5)[3]	40.4(24.8-109.4)[4]	.6 (.2 -2.7)	5.8 (0 -19.6)	6.6 (.5 -21.3)	47.0(27.0-127.1)
12	17.4(12.4-21.4)[3]	44.9(26.8- 74.6)[4]	.8 (.1 -1.7)	5.0 (0 -14.8)	5.8 (.4 -16.0)	50.7(27.2- 82.9)

[1]Mean weight of plants followed by range in parentheses.
[2]Includes petioles.
[3]Based on 5 representative plants.
[4]Includes leaf weights.
[5]Stoneville 213.

Table 5.--*Cotton (Deltapine 16) seedling emergence. Robles Junction, Ariz., 1976*

Field	Planting date	Percent emergence on indicated date									
		0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100
F3	Apr. 7	Apr. 16	Apr. 17			Apr. 21		Apr. 22	Apr. 23*[1]	Apr. 24-25	Apr. 26
F3	10	16	21		Apr. 22				23*-4		25
F3	21	27				28	Apr. 29			30* - May 1	May 3
F5	7	16	21-2					23-4	25-6*	Apr. 27-May 1	3
F5	8	21	22			23		24	25-6*	Apr. 27-30	1
F6S	9	21-2				23			24-5*	26-9-	Apr. 30
F6S	26							May 3		May 5*	May 7
F6S	8	21	22			23		Apr. 24	25-6*	Apr. 27-9	Apr. 30
F6W	9	22		Apr. 23-4	25	26	27		28-9*	30-May 3	22
F9E	19	27				28			29-30*		
F6E	22	28				29			30*	1-3	May 5
F6E	22	27-8					29		30*	1	3
F6E	21	27			28				29*-30	1	3
F6E	20	26-7				28			29*	Apr. 30-May 1	3
F6E	10		23	24	25	26			27*-8	Apr. 30	1
F2	May 10	May 17			May 19						22*
Percent of emerged plants with cotyledons spread											
F3		Apr. 21				22			23-5	26-8	Apr. 29
F3		21	22			23		24	25-6	27-8	29
F3		27-8-9				30-May 1			May 3		5
F5		21-2				Apr. 23-4	25-6-7		Apr. 28-May 1		
F5		21-2	23			24-6		27	Apr. 28-May 1		
F6S		21-2		Apr. 23				24	Apr. 25-8	29-30	
F6S		May 3				May 5				May 7	May 10
F6S		Apr. 21-2				Apr. 23-8			29	Apr. 30	
F6W		22		23-7				28-29	30-		
F9E		27-8				29-May 1					3
F6E		28-9		30-May 3							5
F6E		27-9		Apr. 30		1				May 3	5
F6E		27-8				Apr. 29-May 1			May 3		5
F6E		26-7-8		29		Apr. 30-May 1				3	5
F6E		23-4		25-6	Apr. 27	Apr. 28-9			1		
F2									19	22	
Percent of plants with 1st leaf visible											
F3		28						May 1		2	3
F3		29-30						1	3		5
F3						May 5				7	10
F5		30		May 3				5			
F5		May 1					May 3	5			
F6S		1							3-5		
F6S		10							5		12
F6S		1				3					
F6W		3				5				7	10
F9E		3			May 5					7	10
F6E			May 5			7				10	12
F6E			5						7		10
F6E					5				7		10

Table 5.--*Cotton (Deltapine 16) seedling emergence. Robles Junction, Ariz. 1976*--Continued

Field	Percent of plants with 1st leaf spread									
	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100
F6E						May 5		May 7		May 10
F6E	May 1	May 3		May 5				7		10
F2	24									26
F3	Apr. 29-30		May 3				May 5			5
F3	May 1	3			May 5				May 7	10
F3	12			10						12
F5	Apr. 30		5				7		10	12
F5		3		5				7	10	12
F6S		3		5				7		10
F6S		14								17
F6S	May 3			5				7		10
F6W	5					7			10	12
F9E	7				10				12	14
F6E	10		12							14
F6E	10								12	14
F6E				10					12	14
F6E				10					12	14
F6E	5			7			10			12
F2					28					28
	Percent of plants with 2d leaf visible									
F3	1-3						5	7	10	
F3	3				5			7		10
			7				10			12
F5	3		5		7				7	10
F5	3		5					10		12
F6S	3			5					7	10
	14									17
F6S				5					7	10
F6W	5			7				10		12
F9E	7				10				12	14
F6E					10			12		14
F6E					10				12	14
F6E					10				12	14
F6E					10				12	14
		7						10		12
F2										28
	Percent of plants with 2d leaf spread									
F3								7	10	
F3								10		
						12				
F5							10		12	
F5					10			12		
F6S									12	
F6S										
F6S									10	
F6W								12		
F9E					12			14		
F6E			12					14		
F6E			12						14	
F6E			12						14	
F6E				12						14
F6E										12
F2										
	Percent of plants with 3d leaf visible									
F3										10
F3										10

Table 5.--*Cotton (Deltapine 16) seedling emergence. Robles Junction, Ariz. 1976*--Continued

Field	Percent of plants with 3d leaf visible									
	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100
F3										May 12
F5		May 12								12
F5			May 12							12
F6S										12
F6S										17
F6S										10
F6W		12								12
F9E										14
F6E										14
F6E										14
F6E										14
F6E		14								14
F6E			12							12
F2										

[1]Asterisk indicates row was readily visible.

Table 6.--*Final plant part weights, 1973-74*

Location	Date	Weight of plant parts (grams)[1]				
		Stems and roots	Bolls			
			Green		Dry	
			Burrs	Seed cotton	Burrs	Seed cotton
Robles Junction.	Sept. 25, 1973	25.3(17.4-39.4)			16.0(11.3-27.1)	36.8(23.0- 60.8)
	Sept. 9, 1974		0.3(0-1.7)	0.2(0-2.1)	13.8(7.4-25.7)	44.2(22.1- 77.9)
Marana	Sept. 27, 1973	24.4(20.5-61.0)			20.7(6.7-36.7)	59.1(17.9-111.5)

[1]Mean weight with range in parentheses.

Table 7.--*Retention of fruit through the growing season, Marana, Ariz., 1974*

Date fruit tagged	Fruit per plant subsequently-- Lost No.	Lost Percent	Retained No.	Retained Percent	Retained Percent of final crop[1]	Mean final node holding harvestable boll[2]	Bolls produced after tagging date No.	Bolls produced after tagging date Percent of final crop[1]
Squares								
June 21	1.0±1.0	35	1.9±1.9	65	12	11.2±1.8		
28	5.6±7.3	43	7.3±3.2	57	42	15.6±1.8		
July 8	10.2±5.2	57	7.7±4.2	43	53	18.4±2.9		
17	9.4±6.4	69	4.2±3.0	31	28	20.2±2.6		
23	9.6±6.7	66	5.0±3.8	34	29	21.9±3.0		
29	9.1±6.8	71	3.7±4.7	29	23	23.7±2.4		
Aug. 5	5.8±4.8	66	3.0±3.6	34	19	24.4±3.0		
12	1.6±1.7	41	2.2±2.1	59	19	24.9±3.0		
Blooms								
June 21	0		0		0			
28	.03	21	.1± .3	79	1			
July 8	.1± .3	25	.3± .6	75	2			
17	.3± .5	28	.7± .8	72	5			
23	.3± .5	30	.6± .8	70	4			
29	.6±1.0	45	.7±1.0	55	4			
Aug. 5	.3± .6	66	.2± .4	34	1			
12	.2± .5	69	.1± .4	31	1			
Bolls								
June 21	0		0		0		14.2±6.4	88
28	.03	9	.3± .7	91	2		9.8±5.8	56
July 8	.1± .4	7	1.7±1.6	93	12		5.0±4.0	34
17	1.4±2.1	18	6.2±3.7	82	42		3.8±3.8	25
23	1.8±2.5	19	7.4±3.6	81	42		4.4±4.9	25
29	1.8±2.0	17	8.7±3.3	83	54		2.9±2.8	18
Aug. 5	2.8±2.2	20	10.9±4.3	80	69		1.7±2.0	11
12	1.0±1.3	10	9.2±4.1	90	78		.4± .7	3

[1]On plants tagged on indicated date.
[2]For date of tagging.

APPENDIX B.--AGRONOMIC DATA

Year: 1973.

Location: Robles Junction, Ariz. (R. G. Buckelew, field F6W).

Variety: Deltapine 16.

Planting date: Not available.

Emergence date: Apr. 28 (estimated).

Density: 42,100 plant per acre.

Irrigations	Date	Fertilizer	Lb N/acre
Preplanting	Feb. 23-Mar. 1	Anhydrous NH_3	30
Postemergence:			
1	May 18	--do--	56
2	June 11	--do--	34
3	July 3		
4	July 21		
5	Aug. 11		
6	Aug. 30		

Soil type: USDA SCS Type 7J.

Soil description: Deep, well-drained soils with loamy surfaces and clay loam or silty clay loam subsoils. Good water holding capacity and moderate intake and permeability rates.

Year: 1974.

Location: Robles Junction, Ariz. (R. G. Buckelew, field F3).

Variety: Deltapine 16.

Planting date: Not available.

Emergence date: Not available.

Density: 59,200 plants per acre.

Irrigations	Date	Fertilizer	Lb N/acre
Preplanting	Feb. 21-Mar. 7	Anhydrous NH_3	46
Postemergence:			
1	May 1	--do--	49
2	June 8	--do--	8
3	June 27		
4	July 12[1]		
5	July 18[1]		
6	July 30[2]		
7	Aug. 16		

[1]Spot irrigations. May not include plot areas.
[2]Use rainfall quantities for moisture. Irrigation underway when heavy rains occurred.

Defoliated: Aug. 31, 1974.

Soil type: USDA SCS Type 303Ds.

Soil description: Deep, well-drained soils with silty clay loam surfaces and upper subsoils. Texture of lower subsoil, below about 20 inches, is medium, ranging from loam to fine sandy loam. Good water holding capacity and moderate intake and permeability rates.

Year: 1976.

Location: Robles Junction, Ariz. (R. G. Buckelew, field F6W).

Variety: Deltapine 16.

Planting date: Apr. 9.

Emergence date: Apr. 26.

Density: 29,100 plants per acre.

Irrigations[1]	Date	Fertilizer	Lb N/acre
Preplanting	Mar. 20	Anhydrous NH_3	48
Postemergence:			
1	May 15	--do--	15
2	June 16	--do--	18
3	July 5	--do--	22
4	July 28		
5	Aug. 15		
6	Sept. 1		

[1]Total water, 71 inches.

Defoliation: Sept. 21.

Gin yield: 1,162 lb per acre.

Soil type: USDA SCS Type 7D.

Soil description: Deep, well-drained soils with clay loam or silty clay loam surfaces and subsoils. Good water holding capacity and moderate intake and permeability rates.

Year: 1976.

Location: Robles Junction, Ariz. (R. G. Buckelew, field F6W).

Variety: Deltapine 16.

Planting date: Apr. 9.

Emergence date: Apr. 26.

Density: 10,400 plants per acre.

Irrigations[1]	Date	Fertilizer	Lb N/acre
Preplanting	Mar. 20	Anhydrous NH_3	48
Postemergence:			
1	May 15	--do--	15
2	June 16	--do--	18
3	July 5	--do--	22
4	July 28		
5	Aug. 15		
6	Sept. 1		

[1]Total water, 71 inches.

Defoliation: Sept. 21.

Gin yield: No data.

Soil type: USDA SCS Type 7D.

Soil description: Deep well-drained soils with clay loam or silty clay loam surfaces and subsoils. Good water holding capacity and moderate intake and permeability rates.

Year: 1973.

Location: Marana, Ariz. (University of Arizona Experimental Farm, field B4).

Variety: Stoneville 213.

Planting date: Apr. 13.

Emergence date: Apr. 30.

Density: 15,500 plants per acre.

Irrigations	Date	Inches of water	Fertilizer	Lb N/acre
Preplanting	Mar. 20	12	([1])	
Postemergence:				
1	June 6	6		
2	July 15	6	Anhydrous NH_3	30
3	Aug. 7	6		
4	Aug. 24	6		

[1]300 lb 16-20-0 applied Feb. 15 before bedding.

Weed spray at final cultivation: Applied Lorox (=linuron; 3-(3,4-dichlorophenyl)-1-methoxy-1-methylurea) on July 6 at 1-1/8 lb per acre.

Soil type: USDA SCS Type Gba.

Soil description: Well drained, medium texture. 6-14 inches loam. Stratified loam, very fine sandy or silt loams. High water holding capacity. Moderate permeability (0.25-0.5 in/hr intake). 9.5-inch water holding capacity.

Year: 1974.

Location: Tucson, Ariz. (Midvale Farms, field C3).

Variety: Deltapine 16.

Planting date: Apr. 11.

Emergence date: Apr. 25 (estimated).

Density: 79,800 plants per acre.

Irrigations	Date	Fertilizer	Lb N/acre
Preplanting	Mar. 14	Anhydrous NH_3	70
Postemergence:			
1	May 18		
2	June 14	--do--	21
3	July 15		
4	Sept. 4		

Soil type: USDA SCS Type 301J.

Soil description: Well drained, medium texture to 60 inches or more. Surface (8-20 inches) layers of loam to very fine sandy loam. Loam to 30 inches. Substrate stratified loam, silt loam, or very fine sandy loam to 60 inches or more. High water availability. Moderate intake and permeability. 9.5-inch water holding capacity.

APPENDIX C.--FORTRAN TERMS

AGE(K,L,M) - Age of each node.

AGENOD - Age of node.

AGETOP - Average age of top three mainstem nodes.

CBL - Model calibration factor.

CPF - Model calibration factor.

CSQ - Model calibration factor.

CZN - Model calibration factor.

DAYTYM - Daylight fraction of 24-hour day.

DUMY01 - Dummy variable used in calculating fruit growth during day.

DUMY02 - Temperature factor in boll growth below 28.5°C during day.

DUMY03 - Temperature factor in boll growth above 28.5°C during day.

DUMY07 - Temperature factor in boll growth below 28.5°C during night.

DUMY08 - Temperature factor in boll growth above 28.5°C during night.

DUMY09 - Dummy variable used in calculating fruit growth during night.

DZ - Change in plant height in top internode.

F - Ratio of available photosynthate to that required.

FCODE - Fruit code (1 = square, 2 = green boll, 3 = open boll, 4 = abscised, 5 = square marked for abscision, 6 = boll marked. For abscision, 7 = boll of age susceptible to abscision.)

FLOSS - Fruit loss.

FRATIO - Ratio of fruits and aboveground portions of plants by weight.

FSTRES - Physiological stress affecting fruiting.

GOSSYM - Cotton plant simulation model.

INT - Fraction of solar radiation intercepted by crop.

LAI - Leaf area index.

LT - Less than.

NYTTYM - Nighttime fraction of 24-hour day.

ROWSP - Rows spacing.

SCDLAY - Sum of carbohydrate delays.

TDAY - Average of daytime temperature.

TNYT - Average nightime temperature.

WSTRSD - Water stress day. Fraction of daytime period during which leaf is turgid enough (above -7 bars) for growth.

WSTRSN - Water stress night. Fraction of nighttime period during which leaf is turgid enough (above -7 bars) for growth.

XTR4 - Model calibration factor.

Z - Plant height.

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